Advanced microcalorimeter arrays for next-generation x-ray missions

Completed Technology Project (2017 - 2019)

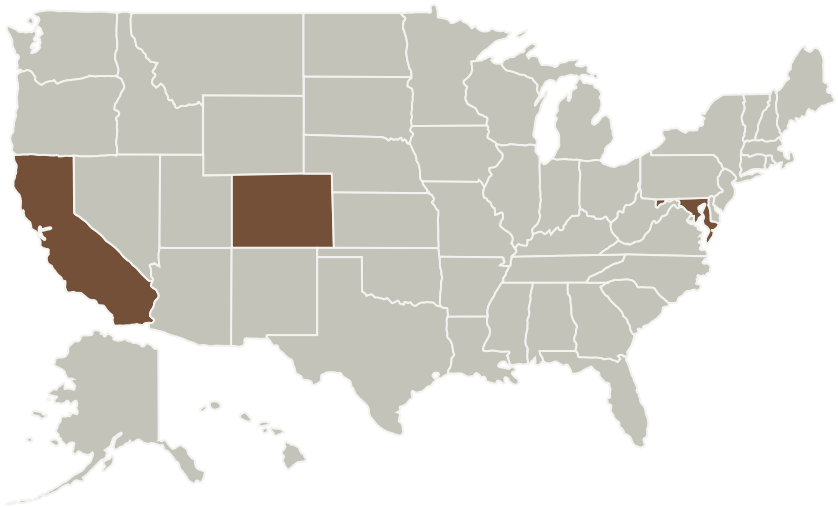
Project Introduction

We will develop several technologies to enable significantly larger arrays of x-ray microcalorimeter sensors for future NASA missions such as the X-ray Surveyor. In particular, we will develop sensor fabrication and readout strategies compatible with arrays of 10^5 or more sensors. Our readout strategies rely, in part, on a novel switching element recently developed at NIST that has not previously been used with microcalorimeter sensors. Our work will enable in-focal plane multiplexing in which the sensors and readout circuitry are co-located. The scalability of this approach is highly favorable for large sensor arrays. We will also develop x-ray microcalorimeters using novel materials consisting of doped AlMn alloys. These materials allow precise control of the transition temperature over 150 mm wafer area. This wafer scale is necessary for arrays of 10^5 to 10^6 sensors.

Anticipated Benefits

The results of this project serve the needs for future "in situ life detection" missions such as are being conceived to interrogate the ocean worlds of the outer solar system (e.g. Titan and Europa). This technology addresses NASA's need to develop uniquely universal approaches to detecting lifeforms that may be considerably different from what is currently recognized as life.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
National Institute of Standards and Technology(NIST)	Lead Organization	US Government	Boulder, Colorado

Primary U.S. Work Locations	
California	Colorado
Maryland	

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

National Institute of Standards and Technology (NIST)

Responsible Program:

Astrophysics Research and Analysis

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

Joel Ullom

Co-Investigators:

Kent D Irwin
Daniel S Swetz
Charles J Titus
Julie Weiblinger
Kelsey Morgan
Gene C Hilton
John A Mates
Peter J Lowell

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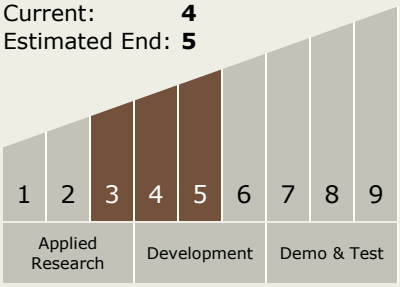
Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System